Sector 7 Operation

Eric Dufresne, Sector manager

SAC review, Feb 17, 2004

Outline

- Beamtime usage, staffing, operational funding.
- Description of the beamlines and facilities for General Users.
- Current issues.
- Projected upgrades, improvements.

7ID Beamtime usage

- Beamtime sharing: member institutions (15%), beamline scientists (20%), PUP (20%) and APS General Users (45%). GU on 7ID since Oct. 2002.
- The beamline has been fully scheduled for several years now. GU program is oversubscribed by factor 2. The Sector Executive Committee decides the allocation of beamtime. The schedule is posted on the web site.

Current beamline user support

The S7 staff are fully committed to support all users, and to operate a strong open-access GU program. The beamline scientists below have responsibility for specific hutches, but are available to help users across all the facilities wherever needed.

Eric Dufresne: Sector manager, beamline scientist.

Dohn Arms: Beamline scientist. (7ID-B, D)

Bernhard Adams: Beamline scientist, temporarily assigned to Sector 7.

Eric Landahl: Beamline Scientist (7ID-D)

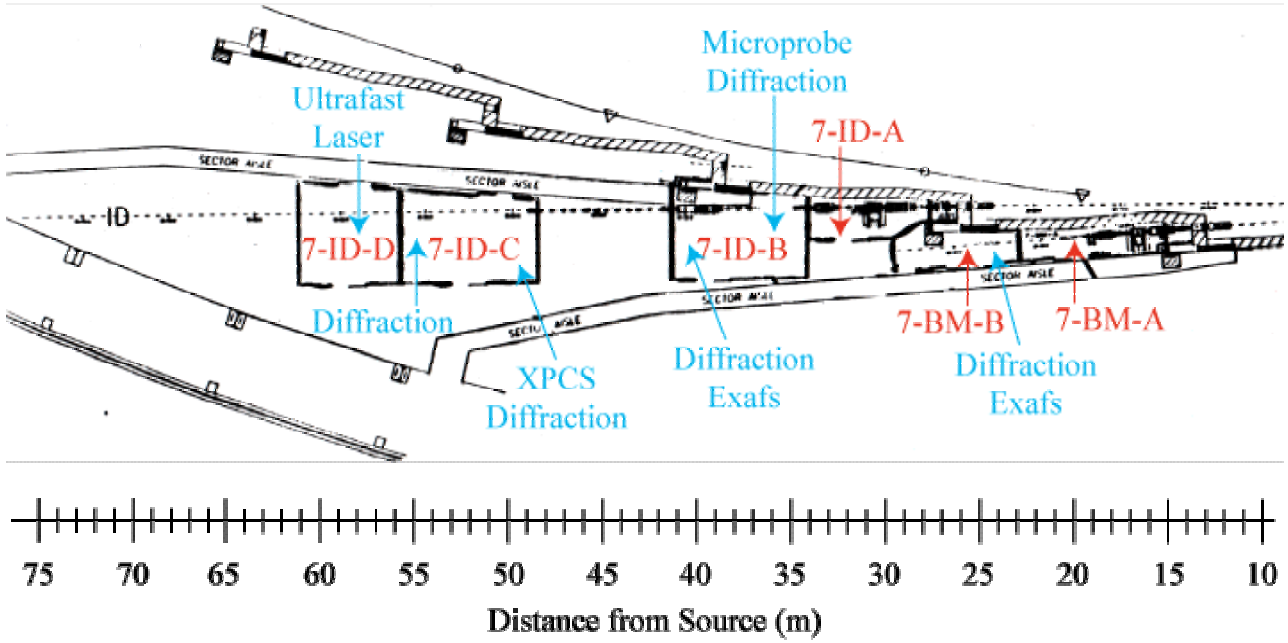
Don Walko: Beamline Scientist (7ID-C)

No technicians since 1999 (one might be hired this year to be shared between 7 and 8ID), no engineers (we will need help from the APS Engineering group for planned upgrades).

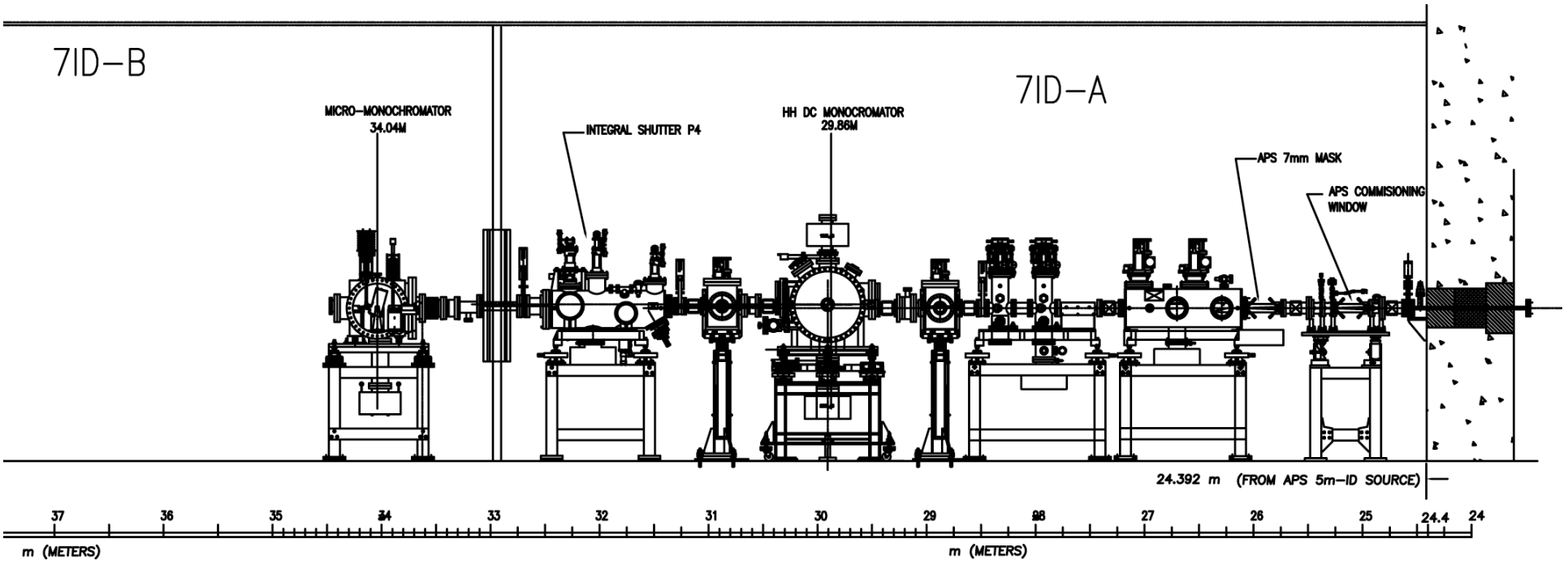
MHATT-CAT Beamline capabilities

- On 7ID, 3 experimental hutches with white, pink, and monochromatic beam are fully operational.
- 7BM, 2 white beam hutches are built. Commissioning and final design is ongoing.

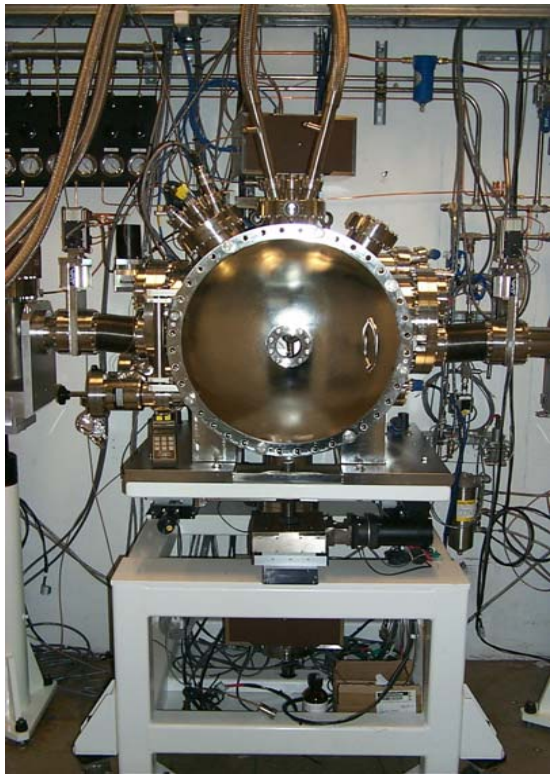
Plan view of MHATT-CAT beamlines showing the optical enclosures and experimental stations

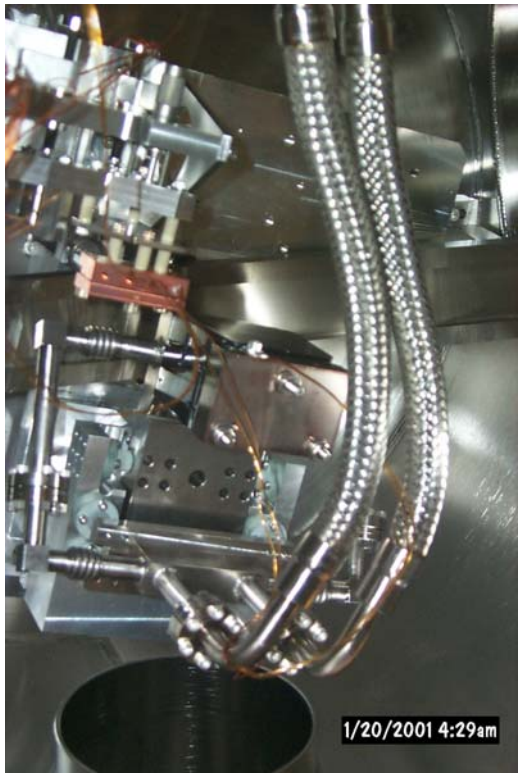


7ID-A and B optics



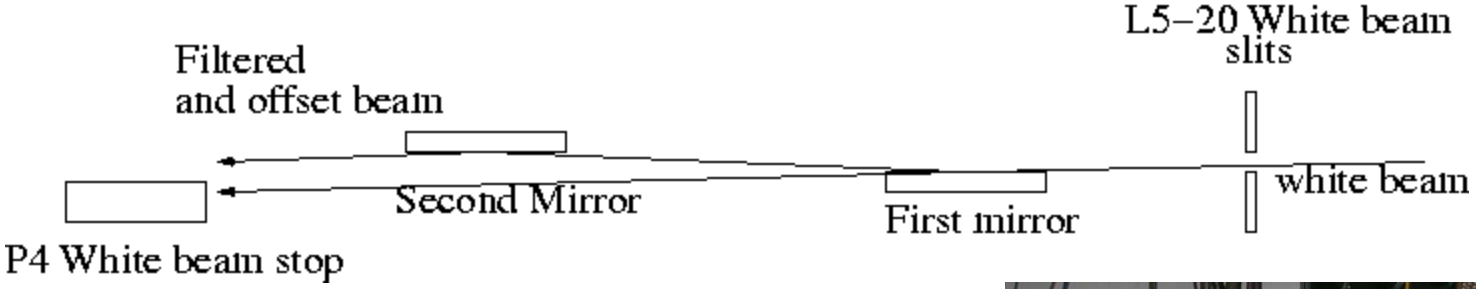
7ID-A HHL Monochromator

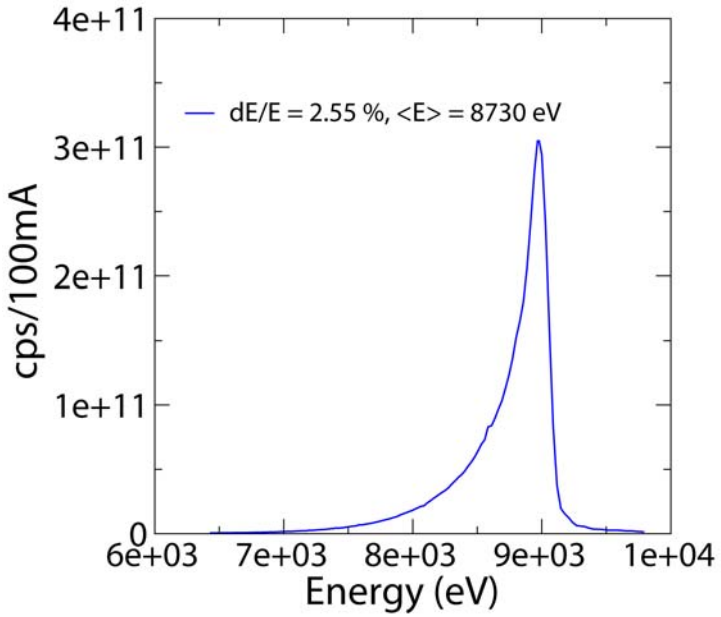


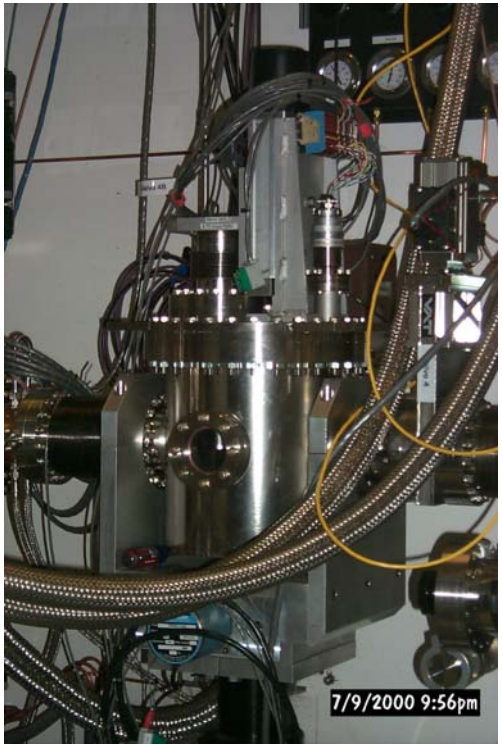


Recent stabilization efforts combined with top-up operation provide excellent beam stability in 7ID-C and D.

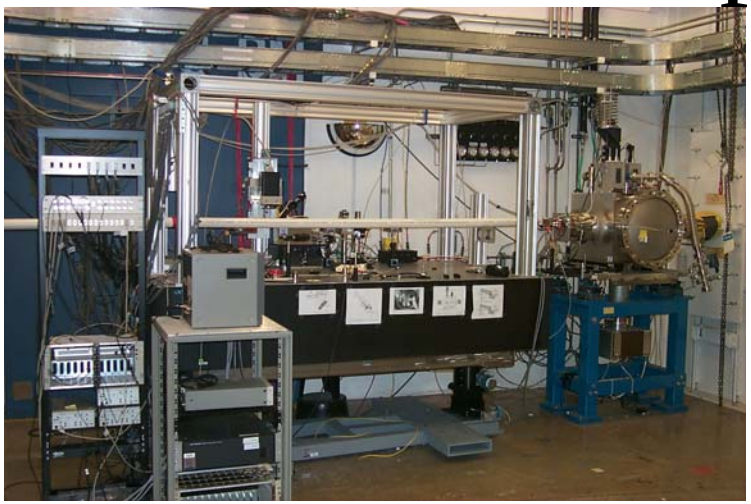
7ID-A Pink beam mirror filter

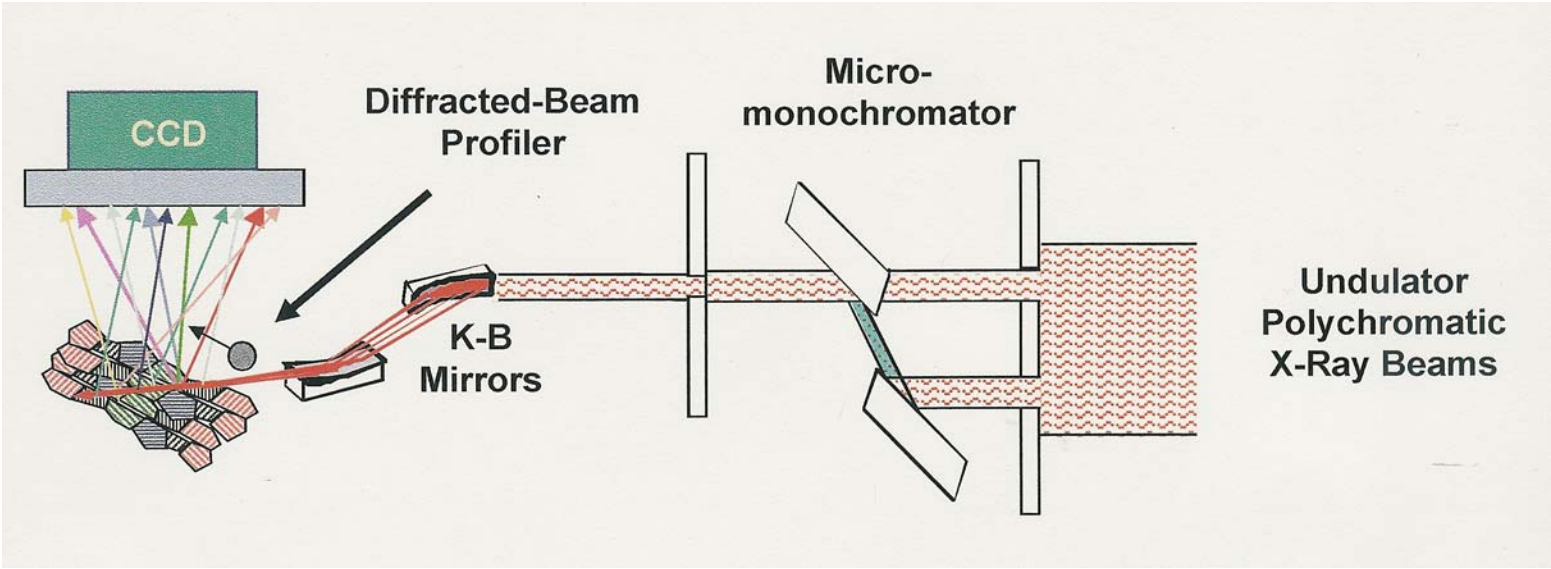




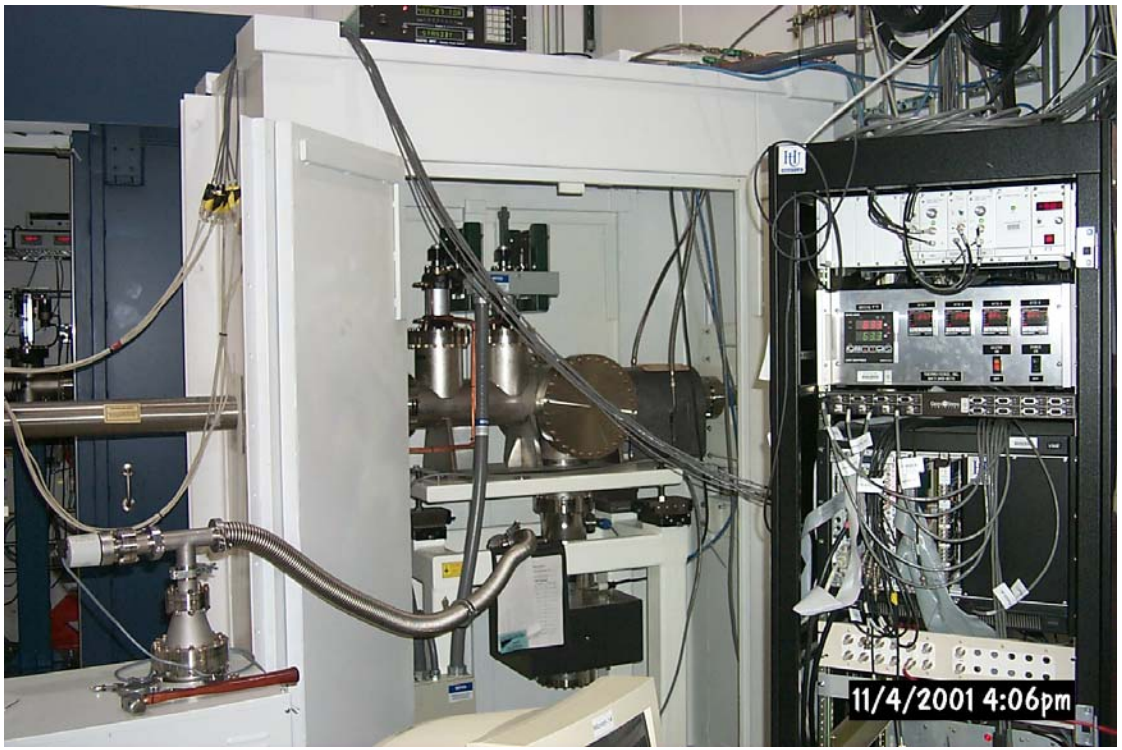


7ID-B Hutch, white beam diffraction set up



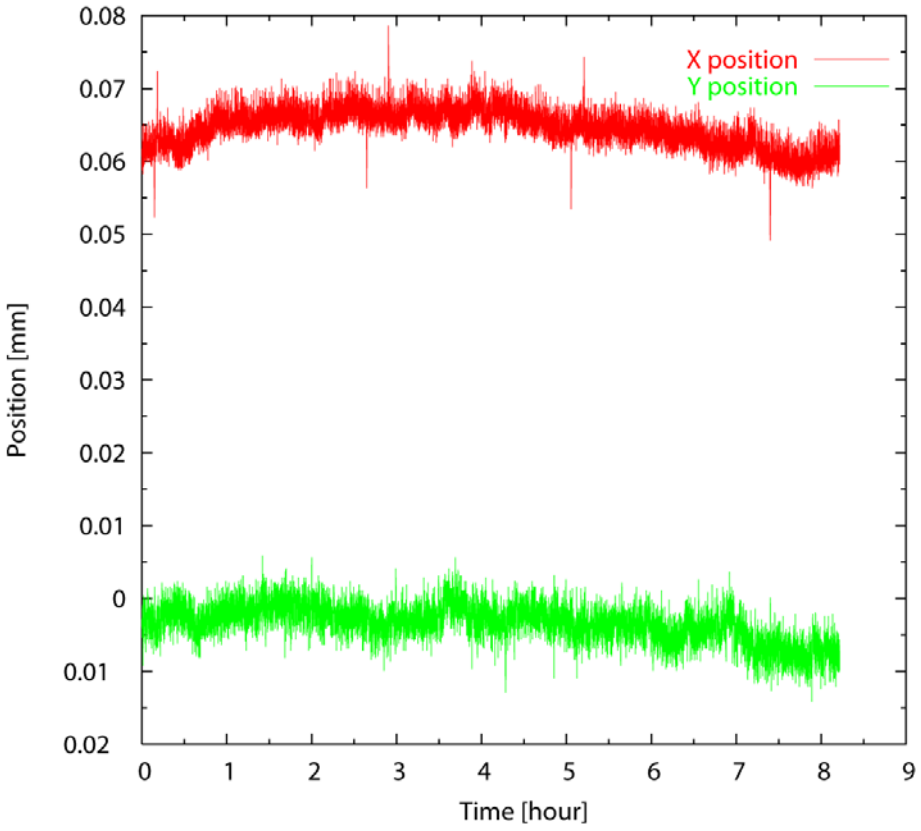


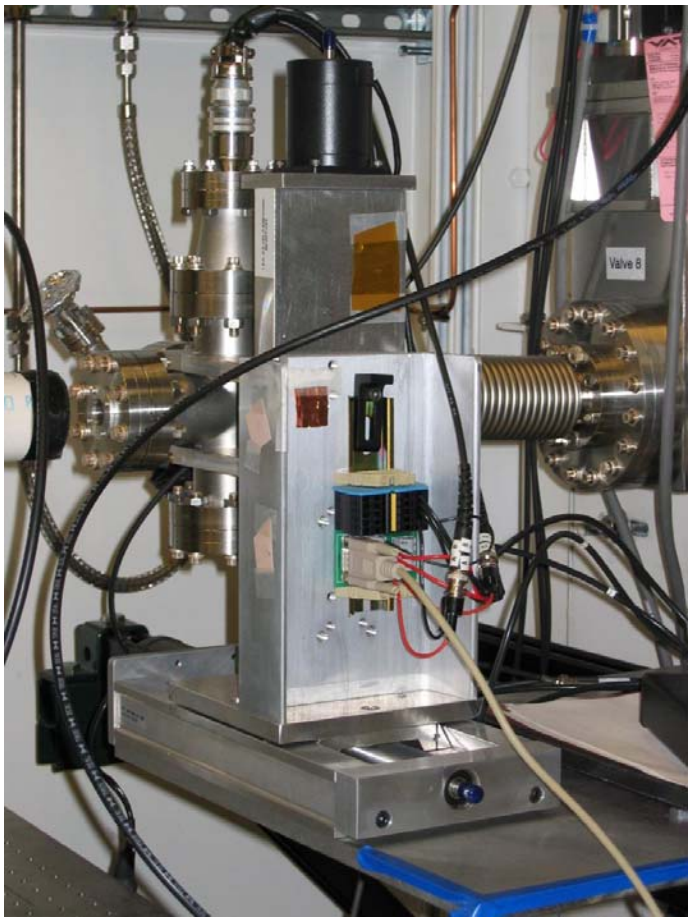
7ID-B minihutch



P5, fixed white beam stop and monochromatic shutter.

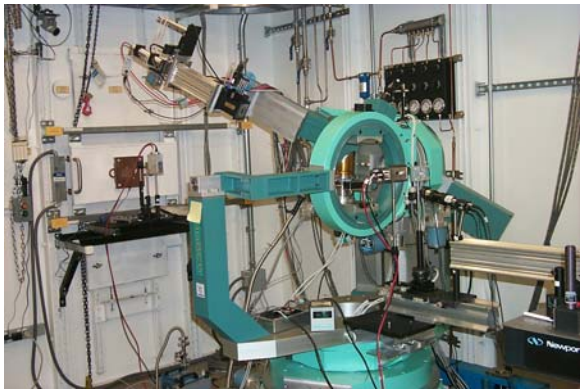
7ID-C X-ray BPM

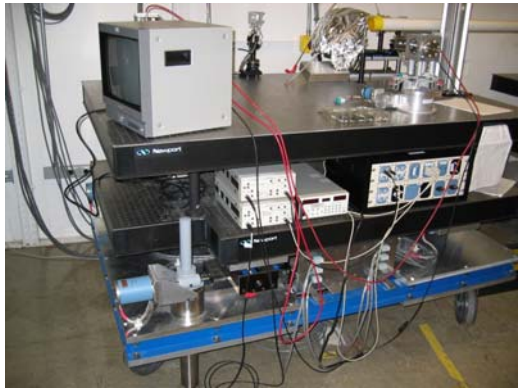


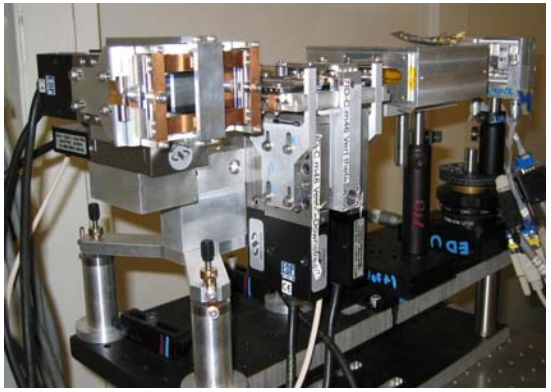


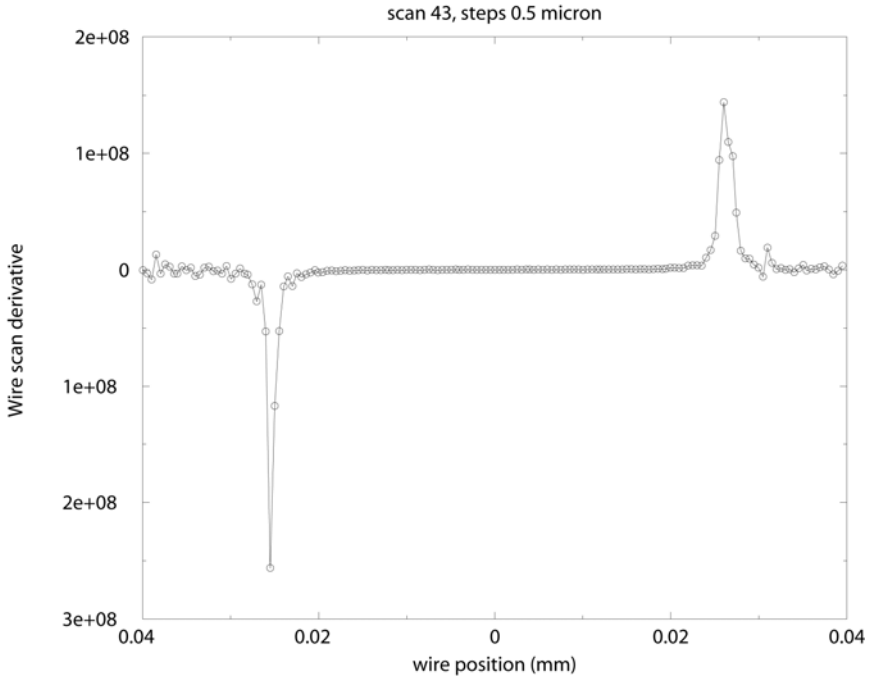
Built in 2001 by an undergrad intern from UofM (Jesse Guzman). Provides beam stability and positioning information with +/- 1 micron precision.

7ID-C hutch set ups



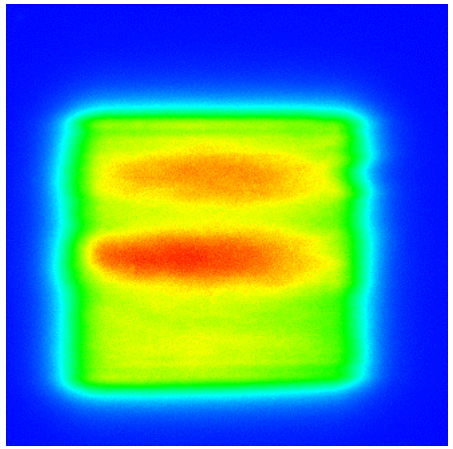


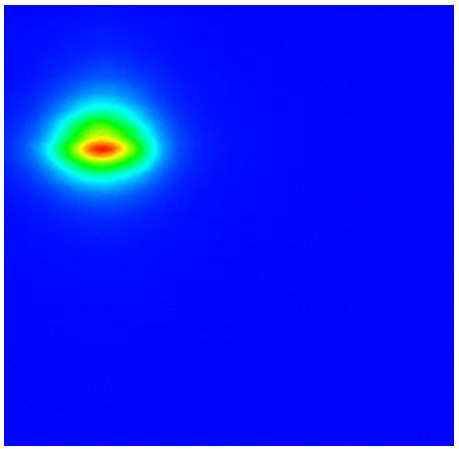




7ID Focusing optics development

- To provide inexpensive, large acceptance optics for low demagnification geometry, we chose to test Compound Refractive Lenses (CRL).
- First demonstration of Li used in CRL done at 7ID (APL 79, p4085)
- Current status: 2D focusing, with a gain of 18x, 0.45mm x 0. 45mm beam focused to a spot size of 81 by 126 μm FWHM. Demonstration of parabolic coin style lens with gain of 40x (RSI 2004). See poster by Nino Pereira.



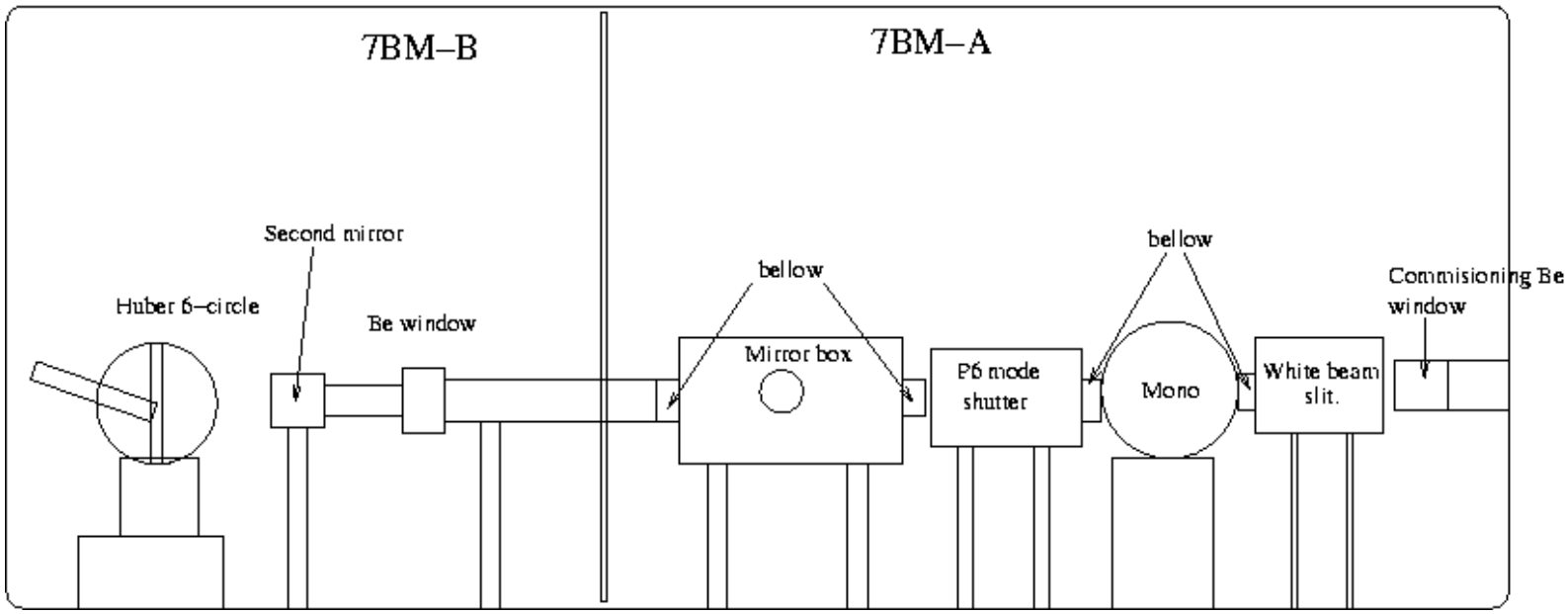


Eco Pulse, Inc

7BM mission

- Science: Condensed Matter/Materials Science, Biology (J. P.-H.’s talk), Geology (RC intro), Instrumentation development. The PUP would provide access to APS groups (OFM,DP), but the science program is the main motivation for 7BM.
- Methods: time-resolved techniques, EXAFS/general spectroscopy, thin film/surface diffraction, general diffraction.
- It will provide additional beamtime for experiments where the brilliance of an ID line is not needed.

7BM beamline design



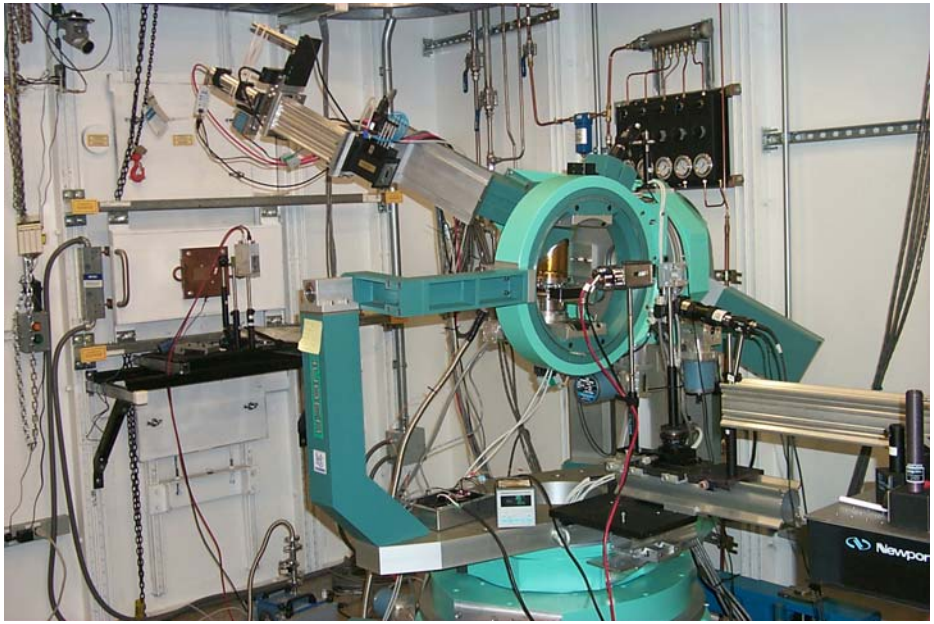
Simple design, similar to 7ID with additional toroidal focusing mirror. Unfocused white, or Si (111) monochromatic beam possible (6-27 keV). Focused monochromatic or pink beam available in 7BM-B. Cut off 20 keV.

90 % of the equipment was procured by Howard University. The mirror is procured from Oxford-Danfisik by the Michigan Life Science Initiative. It should be delivered at the end of Aug. 2004. The 7BM-B Huber is commissioned.

Scientific techniques and equipment available to General Users

- Time-resolved X-ray diffraction and spectroscopy following an Ultrafast fs-laser excitation(7ID-D).
- Coherent Bragg-Rod Analysis, surface and interface diffraction (7ID-C Kappa, planned for 7BM-B Huber)
- Microdiffraction and microfluorescence (7ID-B, C), spectroscopy (projected for BM-B).
- Two general purpose motorized tables in 7ID-C, GSE-CARS 100 mm long KB mirror pair (C+D).
- Displex, high vacuum X-ray oven, and various fast CCD cameras are available (including a fast direct detection CCD)

Current issues on 7ID



Broken Kappa table jack on Sep. 30 2003. Temporarily replaced by 7BM-B Huber. No significant beam time lost! The kappa base was shipped to France to return in April with new upgraded jacks. Example of staff commitment to the user program.

Beamline scientists R&D

- With the arrival of E. Landahl in July 2003, the group can now fully support external laser user and attract outside users. EL intends to develop in the near future time-resolved spectroscopic techniques on 7ID to complement the ultrafast diffraction program.
- ED is interested to develop focusing pink beam optics to enable studies of nanoscale material photo-excited by the laser.
- Our staff scientists are actively involved in current research programs, and also pursue their own research interests. DW is involved in several projects on 7ID studying interfaces and surfaces. DA is interested in using 7BM to study quantum solids like He.

Planned near term upgrades

- Increase the ease of using the beamline for all users and staff (improved hutch ventilation, more motor infrastructure in all the hutches, improved controls hardware and software, improved documentation) {ongoing}
- Procure two general purpose motorized optical tables for quick set up of experiments on 7ID-B, and D (in planning).
- Improve the 7ID-D facility with new laser hutch and more powerful laser (in planning). (EL talk)
- Install the cryocooler on the roof of 7ID-A for improved beam stability. Design beam diagnostic for 7ID-B (in planning).
- Replace the commissioning window in 7ID-A (fall 2004).
- Repair several beamline instruments (HHL mono jacks, mirror filter for pink beam in 7ID-D) (Help from Engineering group needed)
- Procure a 200 mm-long KB mirror for 7ID microfocusing experiments. Gain of 7 possible over existing 100 mm long system. Critical for AMO studies by Linda Young's group where high X-ray and laser intensity are needed on the sample.

near term upgrades (continued)

- Design a horizontally deflecting mirror to focus the monochromatic beam in 7ID-C and D. Easy gain of intensity by a factor 20 for experiments in 7ID-D. Propose to use GSE-CARS large KB design by P. Eng. (2-3 years,$$)
- Complete the construction of 7BM. This beamline will be used for less brilliance demanding experiments, freeing time on the ID line. It will improve our productivity by doubling the available beamtime on S7. Its design will make it simple to operate for our staff and users.

Long term vision

7ID may be a good candidate for a canted undulator beamline. With the existing hutches and most of the existing optics, it may be possible to have one ID provide white beam in 7ID-B, while the other ID brings monochromatic beam in 7ID-C and D. A canted Undulator beamline design would double the available beamtime on the ID line.